

**Fresh Pages - Brackets and Underlines Removed**

A more specific object of the invention is to make use of optico-diffractive indicia on security documents for examining their authenticity at high speed.

A further object of the invention is to provide a novel method of checking  
5 the authenticity of unsorted security documents.

Still further, it is an object of the invention to provide a method of the kind referred to which may be practiced in hand-held devices as well as in document testing and money processing machines.

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Other object of the invention will in part be obvious and will in part appear hereinafter.

#### BRIEF SUMMARY OF THE INVENTION.

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In the accomplishment of these and other objects, the invention, in a currently preferred embodiment, provides for a system of capacitive coupling between a transmitter and a receiver for measuring and evaluating the pattern of electrical conductivity of optico-diffractive indicia provided by discontinuous or  
20 partial metallization layers on, or by zones of metallized layers in different planes of, a security document.

The use of holograms and other optico-diffractively effective indicia for ensuring the authenticity of documents in general and of bank notes in particular  
25 and for preventing counterfeiting is becoming ever more prevalent. The ability reliably to test such documents at high speeds represents a further security step in the evaluation of optico-diffractively effective indicia. Such optico-diffractively effective indicia or holograms usually consist of a metallized layer integrated into documents. In addition to being optically readable, such metallized layers are  
30 electrically conductive, the conductivity varying as a function of the thickness of

the layer. An optico-diffractively effective layer may be any one or a combination of a discontinuous metallization layer, a partially metallized layer or zones of metallized layers in different planes. Different measuring systems for detecting electrical conductivity have become known. Contact-less capacitive coupling has  
5 been found to be particularly useful. In the context of testing security documents for their authenticity, capacitive coupling and the transmission of energy between a transmitter and a receiver are accomplished by bridging an electromagnetic field through electrically conductive security materials or elements. Evaluation electronics at the output of the receiver compare the image of the signal  
10 obtained against appropriate reference signals. The comparison results in a classifying signal for controlling the further operation of the testing device, i.e. operation of the testing device could, for instance, continue in case of a genuine document, or the operation could either be interrupted for removal or "double-checking" of a document detected as a counterfeit or the forgery could  
15 automatically be diverted from the feed path of genuine documents. The image of the signal depends upon the structure of the metallization of the hologram or optico-diffractively effective layer. In the case of a hologram consisting of a discontinuous metallization a plurality of its segments will be of different or at least of characteristic electrical conductivity. These different conductivities have  
20 in practice been shown to affect the image of the signal.

A further improvement of the authenticity check is derived from testing the electrical conductivity in combination with other authenticity characteristics of an optico-diffractive layer or hologram. By incorporating additional authenticity  
25 characteristics in non-metallized segments of discontinuous metallization layers, the characteristics may be tested substantially at the same time as the electrical conductivity. Such additional authenticity characteristics may also be incorporated in partially metallized layers or in zones of metallized layers provided in different planes. In the case of such a compound hologram,  
30 appropriate circuitry combines the signal derived from measuring the electrical

conductivity with the signal representative of the other authenticity characteristic, and delivers an output signal representative of the hologram. The additional authenticity characteristics may be fluorescent, phosphorescent or light absorbing or transmitting properties, or they may differ from their surroundings  
5 by magnetic properties. Hence, the input of the evaluation circuitry may, in addition to the conductivity sensor, be derived from optical and/or magnetic sensors. In order to reduce detection and measurement errors the sensors are preferably mounted closely adjacent each other and in defined positions on a single support to minimize spaces between the sensors. In order further to  
10 reduce error signals, the sensor support is mounted in close proximity of the evaluation circuitry. The entire testing device is preferably mounted within a document processing machine, for instance a bank note counting machine, thereby eliminating the need for additional feed or transport devices.

15 DESCRIPTION OF THE SEVERAL DRAWINGS.

The novel features which are considered to be characteristic of the invention are set forth with particularity in the appended claims. The invention itself, however, in respect of its structure, construction and lay-out as well as  
20 manufacturing techniques, together with other objects and advantages thereof, will be best understood from the following description of preferred embodiments when read in connection with the appended drawings, in which:

- Fig. 1 is schematic sectional view of a processing machine including a  
25 test device in accordance with the invention;  
Fig. 2a is a schematic sectional view of a hologram with demetallized segments;  
Fig. 2b is a voltage-time diagram of an evaluation signal derived from the hologram of Fig. 2a;

Fig. 1 schematically depicts the arrangement of the testing device 4 within the feed path of a document processing machine such as, for example, a bank note counting machine. The machine is provided with an intake roller 1 for withdrawing individual documents from a feed tray of the machine, a plurality of transport rollers 2 imparting movement to documents within the machine, a document guide 3 and a testing device 4. The testing device 4 consists of a plurality of electrodes and sensors of the kind described *supra* which are mounted on a common support and which generate signals in response to different characteristics or parameters of a hologram for evaluation by evaluation circuitry (not shown).

It will be understood by those skilled in the art that the evaluation circuitry connected to the testing device 4 typically includes a memory for storing reference signals representative of the hologram of at least one genuine document. In the case of a bank note examining device, such memory may, however, well store reference signals of all denominations of bank notes in circulation in a given jurisdiction in order to allow the indiscriminate processing of unsorted batches of bank notes.

While as shown the apparatus provides for relative movement between the document and the sensors in one direction only, it will be appreciated that it is within the ambit of the present invention to bring about relative movement in orthogonal directions. Such orthogonal movement is of particular advantage in connection with the examination of holograms composed of a plurality of concentrically or eccentrically arranged annular segments.

Fig. 2a is a schematic sectional view of a hologram including a support layer or substrate 11 and a partially metallized layer 12 deposited thereon. Between the metallized parts 12 of the layer there is a plurality of interspersed

1. A method of testing the authenticity of a document provided with at least one optico-diffractively effective security indicium comprising a pattern of metalization of different electrical conductivities, comprising the steps of:

storing a signal representative of the electrical conductivity of the security

5 indicium of a genuine document;

moving a document along a predetermined path;

capacitively coupling a voltage to the security indicium by capacitive coupling;

measuring the voltage in the security indicium and deriving therefrom a

10 signal representative of the different electrical conductivities; and

comparing the derived signal against the stored signal.

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